From Your Brain Sings Before You Do

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For Voice Professionals

Appendix I

Neurodidactics

Though the title includes the word *neuroscience*, this book is actually about neurodidactics in singing. Neurodidactics is the intersection of neuroscience and education, the goal of which is to apply what we know about how brains work to create effective and positive learning. Here, of course, we've added a third category of intersection: singing.

Other than this book, you will find little or no published information on neurodidactics for singing. It may be that this field is simply too new, or that the established work has been in service to classroom education. It may be that the inclusion of motor memory and predictive processing into the overall educational or pedagogical framework makes studying it too complicated. Or perhaps the educational system has not yet caught up to what neurologist and author Oliver Sacks knew: "There is little doubt that regular exposure to music, and especially active participation in music, may stimulate development of many different areas of the brain. In

terms of brain development, musical performance is every bit as important educationally as reading or writing".¹

This book attempts to pave the way for the work of neurodidactics in singing pedagogy and vocal coaching. A decade from now it will undoubtedly seem unsophisticated. The conversation deserves to be started, though, and these ideas demand to be made accessible. Young singers turning to you for help in their journey of musical self-expression deserve, at the least, the tools offered in this book.

The neurodidactics used in NVM training

There are many things we know about how human brains work. You don't have to know the anatomy of the brain, how neurotransmitters work, or a lot of medical lingo to understand functional and educationally useful principles about brains and brain function. This book offers a number of reliable neurological principles that can make voice lessons and vocal coaching easier, more effective, and more fun for both coach and client. I hope that these were offered in ways that were easy to understand and apply.

NeuroVocal Method is an active, growing approach. It continues to become both broader and more nuanced as more smart and generous voice educators engage with its training and tools. As of this writing, the neurodidactics actively applied in NVM coaching are:

- Individual differences
- Selective attention
- Neuroplasticity
- Emotion regulation
- Multisensory learning
- Predictive processing

¹ Scott Horton, "Musicophilia: Six Questions for Oliver Sacks," Harpers Magazine, July 28, 2009

Individual differences

More often than not, training for singing happens in private coaching or teaching environments; one client and one coach. This can be a luxurious situation for the coach, who can adapt to the changing needs of individual clients. It can also be challenging since it requires coaches to release any attachments to rote learning or rigid structures.

It is for this reason that NeuroVocal Method is based on a coaching model, rather than one of teaching. The NeuroVocal coach uses their knowledge to guide the client, honoring the singer's agency and encouraging consistent self-assessment.

The arts attract creative people; those who perceive and process in novel ways. In the context of a group, many of these creatives might be labeled *neurodivergent*, since they appear to vary from what is considered the norm. However, in the context of a private coaching session, they become the norm since there's no need to compare them to anyone else. For example, Robin might be perceived as having an inability or unwillingness to pay attention in a classroom situation because they have a tendency to look away when the instructor speaks, but Robin's vocal coach can realize that this same behavior is what Robin needs to do *in order* to pay attention. This tendency then becomes an observation about an individual client and something that can be easily accommodated, rather than being construed as something negative or difficult.

It's helpful for those of us who work with creative, expressive people to know about different kinds of brains. While it's beyond the scope of this book, I encourage you to learn (even a little) about autism spectrum disorder and attention deficit disorders. You may also want to dive into learning something about mental health disorders. Your ability to understand and accommodate the needs of different sorts of brains will help both you and your clients.

Neuroplasticity

The word *neuroplasticity* describes the ability of neurons to change function, chemical profile, or structure. In a larger sense, these changes will affect neural networks. An oft-used expression that sums up the process of neuroplasticity is *nerves that fire together, wire together*.

Neuroplasticity is the underlying mechanism for creating or breaking habits, growing or decreasing sensitization, adapting to new things, learning and memory, and motor learning. While neuroplasticity is a constant across all brains, different things affect how easily or quickly a brain can change. Age, health, genetics, hormones, and lifestyle can all affect the rate of change in neurons.

NVM employs strategies that stimulate somatosensory neural networks to promote neuronal development, synaptogenesis, and long-term motor learning. Specifically, NVM coaches have observed that when singers are able to focus selective attention on specific sensory input, those singers can quickly access new and unfamiliar motor behaviors. Using these tools, the timeline between the introduction of a new behavior or technique and the familiar acquisition of that skill tends to be surprisingly short when compared to traditional voice training approaches.

We see that as evidence of the effects of neuroplasticity, as an individual exhibits a change in consistent or normalized behavior or experience. In NeuroVocal training, we consistently observe a correlation between the new behaviors and skills introduced to the singer and a consistent or normalized experience of singing over time.

Emotional regulation

The efficacy of NeuroVocal training relies on the singer's sense of agency and emotional safety in the coaching process.

Because of the *inside-out*, sensory-based approach that NeuroVocal offers, it's crucial from the outset that the singer has agency; that they are steering their own ship. Singers need to

understand from the first coaching session that they are engaged in an experiential process. This usually takes some getting used to. The singer is often experiencing a new model that is contrary to the binary or dualistic thinking implicit in the typical teacher-student relationship. Agency, nuance, and horizontal instruction become the norm when singers realize that they cannot 'get it wrong.'

The coach-client relationship has significantly less inherent hierarchy than the student-teacher relationship. Once a singer understands that this is the new normal, it generally supports a sense of emotional safety in the coaching space. In certain singers, however, making their own artistic choices can produce anxiety. It can feel safer to follow instructions than to make choices, and skilled coaches can offer support as the singer shifts their internal model of music instruction and gains confidence in making creative choices.

NeuroVocal encourages the singer to focus on a sensory experience of motor outcomes for phonation instead of aesthetic judgment of singing sounds. We find that it's difficult (or even impossible) for singers to focus on generating a specific feeling that meets their intention - a task that requires the selective attention knob to be cranked up - and simultaneously experience anxiety or self-criticism. The intention to generate a specific sensory experience, along with the selective attention required to gauge whether that intention has been met, seems to create an internal state that's more emotionally neutral. The emotionally neutral state allows the singer to experience, and then selectively modulate, new vocal behaviors.

The horizontal and experiential process with a kind vocal coach helps with emotional regulation, particularly if the coach is familiar with the *Brains Are Like Cats* phenomenon and has tools to help clients with those sticking points.

A physiological effect that contributes to emotional regulation is a result of the interplay between phonation and the autonomic nervous system (ANS). Phonation has a well-documented relationship with emotional regulation. This connection is rooted in the anatomy and physiology of the larynx, along with its sole source of innervation by the *vagus nerve* (cranial nerve 10 or CN X).

Over the years, I've found a surprising lack of credible research regarding this relationship, but a wealth of observational connections. What we do know is that the vagus nerve innervates the larynx, modulating both phonation and ANS activity. The ANS is the primary regulator of our physiological states that give rise to emotions. The vibrations created by phonation, the controlled and extended exhalations that naturally occur when people phonate for singing, and the intentional use of interoception to guide selective attention all appear to contribute to the calming effect of NeuroVocal work.

Selective attention

Selective attention is a primary driver of neuroplasticity. Neurons function via bioelectric impulses. Engaging selective attention to focus on a specific thing "turns up the volume" on that neural signal. Literally. Focused attention increases the gain of that neural process and decreases "neural noise." It enhances signal-to-noise ratios, improving the brain's ability to discriminate over time. In the case of motor learning, this process eventually makes the new behavior feel automatic.

It's also true that people differ, and it can be difficult for some people to engage their selective attention. Further, singers sometimes hold onto their expectations for particular sonic outcomes. When a singer is listening and judging their sound, they cannot simultaneously engage their selective attention in an efficient way to assess an internal sensory experience. In these situations, NeuroVocal can't work its neuroplastic magic.

Strategies for focusing attention can be borrowed from other education modalities and seamlessly applied to the NeuroVocal process. Each brain is unique, however, and a strategy that works well for one person may not apply to someone else.

Multisensory learning

Few singers have a cognitive understanding of singing as an embodied experience. Singing integrates interoceptive and auditory input with executive function, aesthetic judgement, emotional interpretations, and language processing. When applied by a skilled singer, this dance of neural networks turns into captivating singing. However, in pursuing the acquisition of new vocal or singing skills, it forces the singer into a state of divided attention; cognitive load is invested in managing existing skills. This has the effect of slowing the acquisition of new behaviors and skills.

NVM guides the singer to learn to distinguish between these elements of singing, specifically focusing on using interoceptive information to guide motor outcomes. These processes help singers to first identify singing as an embodied experience, and subsequently to separate, explore, and interpret different sources of sensory input.

Predictive processing

Seldom included in literature for neurodidactics, predictive processing is crucial for the motor learning required for confident and joyful singing.

Predictive processing is the currently accepted unifying theory of cognitive neuroscience, and the approach used in NVM is based on it. The theory states that the brain functions as a prediction machine that constantly generates and updates internal models of the world to predict incoming sensory information. When actual sensory input differs from these predictions, the brain adjusts its models to minimize the discrepancy (prediction error). This process of integrating past experiences with current sensory data is the most efficient way for a brain (not just human brains, *all* brains) to interpret and respond to its environment.

Unlike *any other* applied instrument, everyone who seeks training for their singing has already invested thousands of hours in creating and cementing their motor memory for singing. Each time they have the intention to *sing*, their predictive processing attends to singing in the way it

already knows. Their brain sings before they do. Because of this reality, NeuroVocal focuses on *phonation* outside the context of singing. The absence of an internal model for *efficient phonation* in most individuals means that efficient phonation can be developed with an intention for a specific outcome.

The sensory stimuli of performance situations are overwhelming (exteroceptive, interpersonal, interoceptive, and affective), and the singer's brain must make (ever-changing) decisions about a hierarchy of importance. The cognitive expense of applying executive function to the motor action of singing - as is seen in prevailing vocal pedagogies - is simply not available to the performing singer. However, if the *motor skills* that underlie the singing element of a performance are automatic and based on an assumption of an interoceptive sensory experience (predictive processing), the singer has freed up "cognitive real estate" to focus on managing more of the sensory input involved in performance situations.